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## ADDITIONS AND CORRECTIONS TO A REVIEW OF NORTH AMERICAN PACIFIC COAST BEACH VEGETATION

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Breckon and Barbour (1974) recently reviewed the literature on beach vegetation of the Pacific Coast of North America. Subsequent field observations verified many of their conclusions about structure and distribution of beach communities and revealed new information requiring corrections and reconsideration of some of their conclusions. Our survey ranged from Washington (approximately 48° N latitude) to Cabo San Lucas, Baja California (23° N).

For the sake of brevity, additions, corrections, and deletions for the list of characteristic beach species are summarized in text. The interested

reader can transfer these changes to Table 2 in Breckon and Barbour pages 342-4. Of the 22 taxa listed below, six represent additions, four are deletions, and the rest show modifications in range or nomenclature or both.

The new taxa are narrowly restricted with ranges of less than 5° latitude. Yet, within their ranges they all may be locally abundant and deserve to be recognized as characteristic beach taxa.

Three deleted species, *Lycium brevipes*, *Salicornia subterminale*, and *Suaeda californica*, have Baja California distributions, and Johnson has determined that they are more characteristic of salt marshes and shingle beaches than of the sandy beaches with which we are here concerned. The fourth deletion, *Tanacetum camphoratum*, has a very narrow beach distribution according to herbarium records (1°). We have been unable to relocate it along the coast and suggest that it is extinct in the beach habitat.

Changes in northern (N) or southern (S) limits for the other taxa, and complete nomenclature and range limits for the new taxa (\*), are as follows:

*Elymus mollis*, S:35°

*Cakile edentula*, S:39°30'

*Lathyrus littoralis*, S:34°30'

\**Elymus* × *vancouverensis* Vasey (pro sp.), Maritime Endemic, nothomorph *californicus* Bowden, Maritime Endemic: N limit 50°, S limit 46°

\**Ammophila breviligulata* Fern., Temperate Strand-E.N.A., Introduced: N limit 48°30', S limit 46°

*Polygonum paronychia*, S:35°

*Ambrosia chamissonis* ssp. *cuneifolia*, N:47°30', S:46°30'

\**Agoseris apargioides* (Less.) Greene, Inland-Maritime Endemic: N limit 42° (47° in non-beach habitat), S limit 36°30'

*Heliotropium curassavicum* ssp. *oculatum*, S:22°53'

*Mesembryanthemum chilense*, S:30°

\**Atriplex patula* L., Widespread Inland-Maritime, ssp. *hastata* (L.) Hall & Clem., Widespread Inland-Maritime: N limit 41°, S limit 40°40'

*Atriplex leucophylla*, N:39°30', and change distribution type to Maritime Endemic

*Abronia maritima*, S:22°53'

\**Malacothrix incana* (Nutt.) T. & G., Maritime Endemic: N limit 35°30', S limit 34°

*Camissonia cheiranthifolia* ssp. *suffruticosa*, S:30°

*Distichlis spicata*, N:34°30' (50° in non-beach habitat)

*Sesuvium verrucosum*, change distribution type to Widespread Inland-Maritime

\**Diodia crassifolia* Benth., Maritime Endemic: N limit 22°54', S limit 22°53'.

These floristic additions and subtractions and range adjustments are relatively minor, but they do affect Sorensen coefficients of community (K) and the location of provisional boundary segments (PBS's). De Jong recalculated K values for every 30' segment and selected PBS's at latitudes where K values fell rather suddenly (indicating sudden floristic changes).

When these data are transferred to a map, the Pacific Coast of North America can be broken down into nine eco-floristic zones and subzones (fig. 1). Figure 1 in this paper corresponds to Figure 4 in the Breckon and Barbour article; several changes are apparent. The boundary between North Coastal and Mediterranean subzones within the Temperate

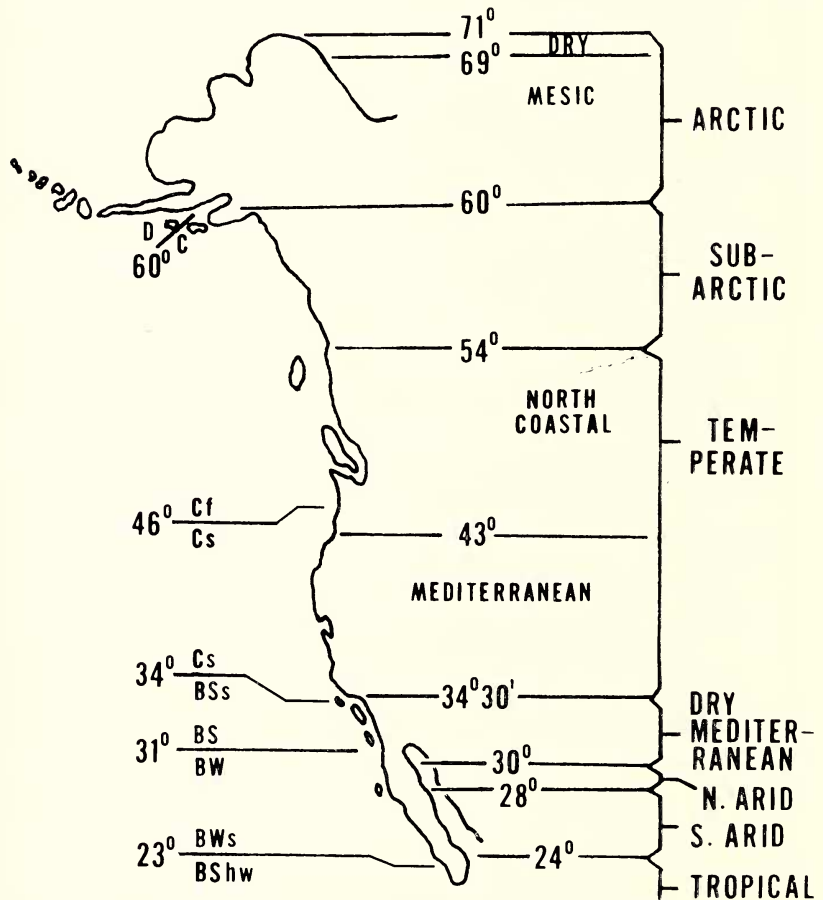


FIG. 1. Pacific Coast eco-floristic zones and subzones and major climatic boundaries (Koeppen system).

zone has been shifted south 30'. This is a minor change and does not correlate any better with a climatic shift at 46° than did the old boundary. That is, the floristic shift at 43° is still anomalous.

Changes to the south are more significant. The boundary between Temperate and Dry Mediterranean zones has been moved 2° south to 34°30', near Point Conception, California. Eight taxa reach their southern limit between 35° and 34°. This new boundary now closely corresponds to a more general floristic boundary recognized by Stebbins and Major (1965). It also correlates well with a climatic shift from Cs (mesothermal) to BSs (semi-arid) climates at 34°. Breckon and Barbour (1974) had drawn the climatic boundary at 37° due to an error in their calculations. The shift to 34° more or less agrees with a map by Durrenberger (1965) that shows BS beginning at 35°45'. Using a precipitation/evaporation index, Thornthwaite (1941) found Point Conception (34°30') to be a significant climatic boundary: in wet years it separates Cd (dry subhumid) from D (semi-arid) climates; in dry years it may separate D from E (arid) climates. In addition, both Durrenberger and Russell show the southern boundary of the fog zone (CsBn) to be around 35°20'. Thus, one may assume that a major climatic shift occurs between 35°20' and 33°45', and our eco-floristic boundary at 34°30' is well within that region.

Another major change in location of the eco-floristic boundaries is that the dividing line between Dry Mediterranean and Northern Arid zones has been moved south 2°30' to 30°. This now agrees closely with a 30°30' southern boundary of the California floristic and faunal provinces proposed by Howell (1957) and Van Dyke (1919, 1929). It also roughly corresponds to a climatic shift from BS (semi-arid) to BW (arid) climates at 31°.

As a result of these boundary shifts, the Northern Arid zone is now quite constricted, occupying only 2° of latitude. This is probably an artificial zone, an artifact of a cliffed coast in that latitude with few and narrow beaches and minimal field work on our part. It does not correlate with any climatic peculiarities. Perhaps it might best be thought of as an ecotone region or as part of the Southern Arid zone, but we have chosen to retain the Breckon and Barbour zone name.

Finally, the region between 24° and 23°30' was categorized as an ecotone by Breckon and Barbour, but we believe its affinities are definitely tropical and so have combined it with the Tropical zone. The northern edge of the Tropical zone correlates closely with a climatic shift at 24° from BWs (arid, summer drought) to BShw (semi-arid, warm, winter drought). Breckon and Barbour had previously placed the tip of Baja California in Aw (tropical, winter drought) by error.

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SYNTHETIC HYBRIDIZATION AND TAXONOMY OF  
WESTERN NORTH AMERICAN *DICHANTHELIUM*,  
GROUP LANUGINOSA (POACEAE)

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*Dichanthelium* has been recognized to differ from the bulk of *Panicum* since 1910 when Hitchcock and Chase described it as a subgenus containing nearly 120 species. Recently elevated to generic rank (Gould, 1974), it differs from *Panicum* by morphological, anatomical, and cytological characters, and by having a C<sub>3</sub>, rather than a C<sub>4</sub>, photosynthetic pathway (Clark and Gould, in press). In contrast to the widespread pantropical and warm temperate *Panicum*, *Dichanthelium* occurs in a geographically limited area, being mostly North American, a few species ranging into the West Indies and to northern South America. Whether it is a recent or ancient derivative from basic panicoid stock presently cannot be ascertained. However, the several kinds of differences between one genus and the other, although each difference alone is possibly not of significance for generic segregation, when taken together indicate natural phyletic units. Even though only a small morphological gap separates *Dichanthelium* from *Panicum*, the segregation can be justified since the two resultant genera are natural and remain large, meeting the recommendation of the inverse ratio between the size of genera and their intervening gap (summarized by Mayr, 1968, pp. 234-238).